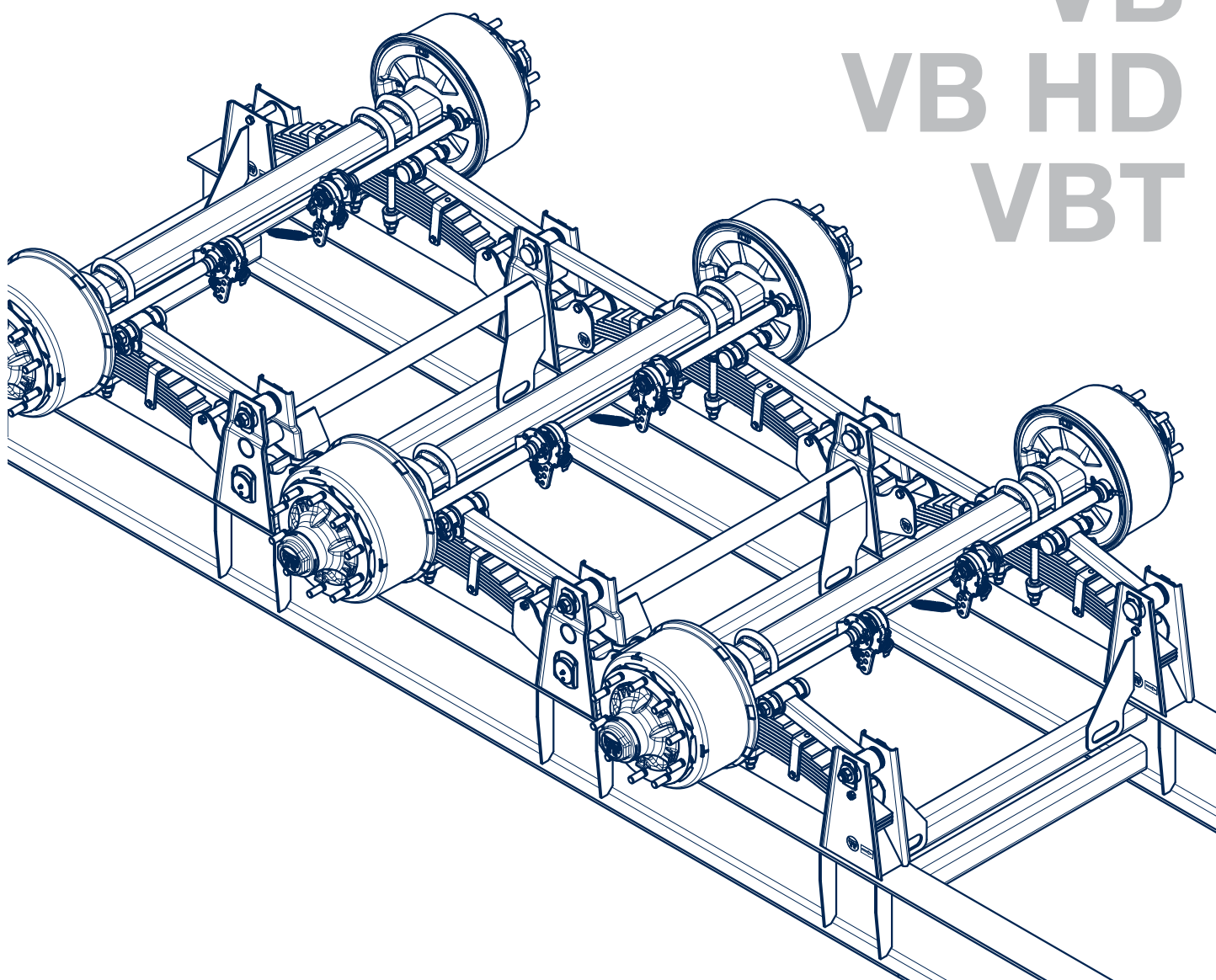


VB
VB HD
VBT



Installation instructions

for mechanical suspensions ECO Cargo,
series VB, VB HD and VBT



BPW is a globally leading manufacturer of intelligent running gear systems for trailers and semi-trailers. As an international mobility and system partner, we offer a wide range of solutions for the transport industry from a single source, from axle to suspension and brake to user-friendly telematics applications.

We thereby ensure outstanding transparency in loading and transport processes and facilitate efficient fleet management. Today, the well-established brand represents an international corporation with a wide product and service portfolio for the commercial vehicle industry. Offering running gear systems, telematics, lighting systems, composite solutions and trailer superstructures, BPW is the right system partner for automotive manufacturers.

BPW, the owner-operated company, consistently pursues one target: To always give you exactly the solution which will pay off. To this end, we focus our attention on uncompromising quality for high reliability and service life, weight and time-saving concepts for low operating and maintenance costs as well as personal customer service and a close-knit service network for quick and direct support. You can be sure that with your international mobility partner BPW, you always use the most efficient method.

Your partner on the path to economic viability



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6.3	Axle alignment correction
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Introduction, notes

Information on the content:

In these installation instructions for BPW ECO Cargo VB suspension units, we would like to outline the technical design guidelines and provide suggestions for installation.

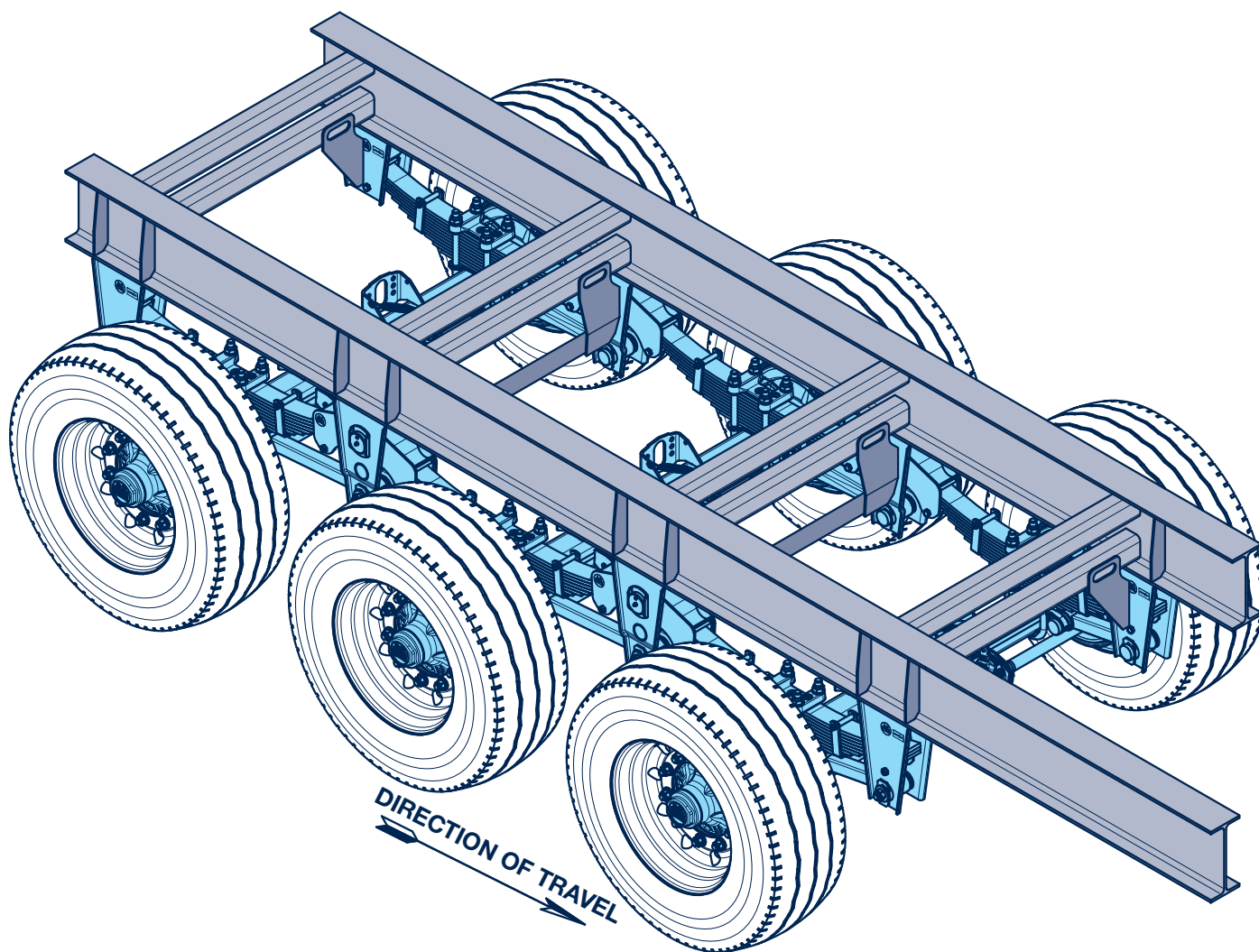
Please note that the drawings accompanying these recommendations should be considered examples, and that dimensions depend exclusively on the vehicle type and its operating conditions.

This information is known to the vehicle manufacturer alone; they must take this into consideration in their designs.

The safety factors for the constructional design of the vehicle frame and substructure must be defined by the vehicle manufacturer.

Detailed design data of BPW suspension units, such as dimensions, spring deflections, etc., can be found in the technical documentation (standard programme and offer drawings).

The warranty shall lapse if installation of the BPW axle system does not correspond to technical guidelines as per relevant BPW installation instructions.



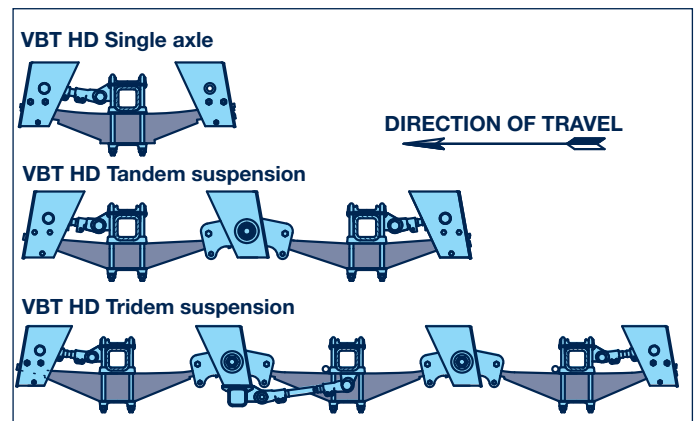
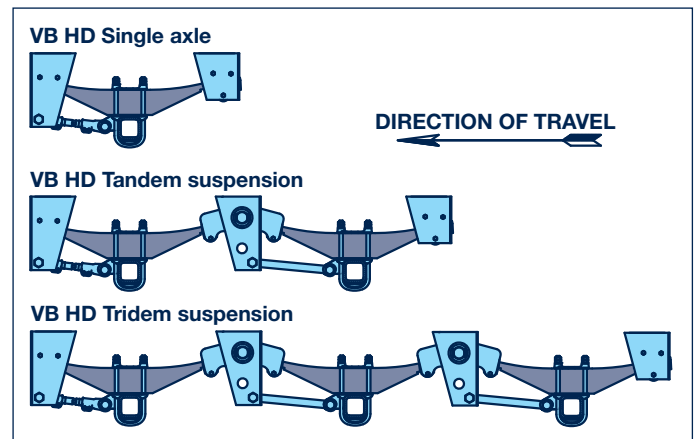
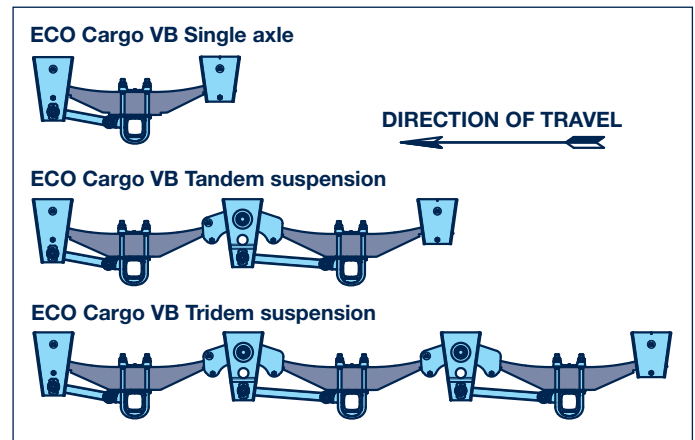
1 BPW ECO Cargo VB-Suspensions

General, designations

- For axle loads of 9 t to 12 t (light series, 76 mm wide springs) and from 14 t to 20 t (heavy series, 100 mm wide springs)
- Deployable with one to three axles, and four-axle suspensions on consultation with BPW
- Available with parabolic springs (up to 12 t) or multi-leaf springs (up to 20 t)
- Static axle load equalisation via equalising beams
- Equalising beams supplied in maintenance-free rubber-steel bushings (9 t to 14 t) or high-quality, durable bronze bushings (9 t to 20 t)
- Low-wear, replaceable spring sliders
- Precise axle-guidance through horizontally-arranged connecting rods
- Easy axle tracking through one rigid and one adjustable connecting rod per axle, adjustable hanger brackets in the ECO Cargo VB
- Maintenance-free connecting rods in rubber-steel bushings
- Stabilisers available for vehicles with a high centre of gravity
- 3-axle suspension can be combined with a BPW rear steering axle LL (up to an axle load of 14 t)
- Hanger brackets with high weldability
- Front hanger brackets available with drawbar connection
- HD/HDE versions also feature thick-walled spring sliders made from hardened and tempered steel alloy

Leaf spring assembly

Series VB	Leaf spring above the axle beam
Series VB HD	Leaf spring above the axle beam
Series VBT	Leaf spring below the axle beam



BPW ECO Cargo VB-Suspensions

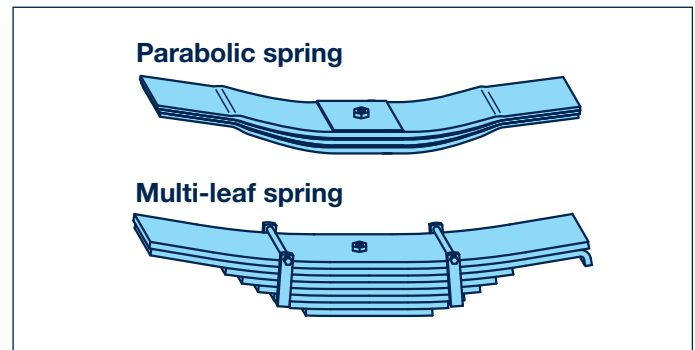
1

General, designations

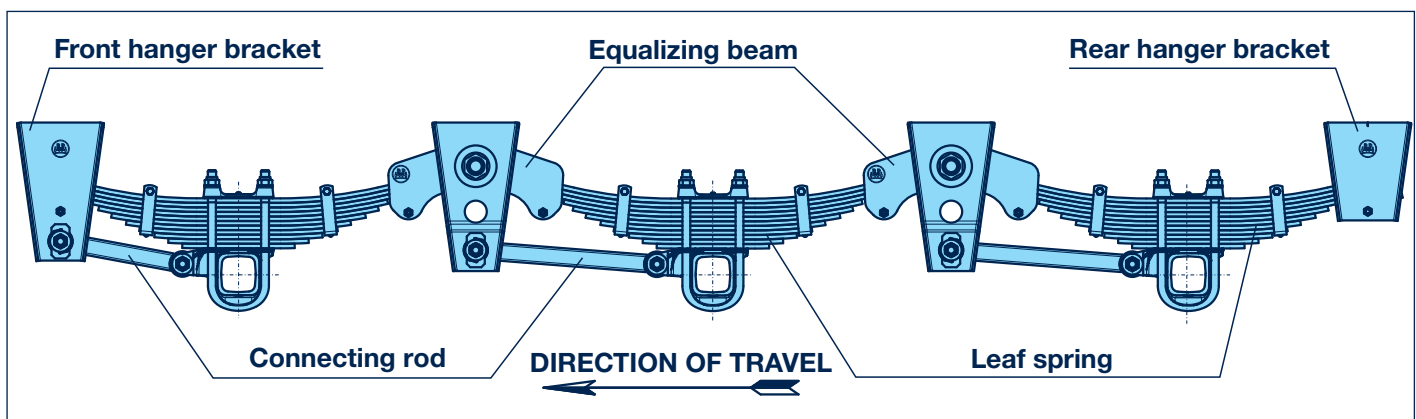
Functioning

BPW VB suspensions are fitted with parabolic or multi-leaf springs. Depending on the specific version, parabolic springs have either two or three parabolic, rolled-out spring layers. Thanks to the efficient use of material, they are lightweight with low installation height. Multi-leaf springs (trapezoidal springs) have multiple spring layers on top of one another, with a constant cross-section and lengths stepped in a trapezoidal shape. They are characterised by their robust nature and good emergency running properties, while it is also easy to replace individual spring layers. The spring ends in multi-leaf springs are mounted with spring sliders both in the hanger brackets and in the equalising beams. This enables unhindered "lengthening" in operation.

The axles are guided by separate connecting rods, which are adjustable in order to enable the lane running to be set easily (for ECO Cargo VB, adjustment is via the hanger bracket, while ECO Cargo VB HD features adjustable connecting rods on one vehicle side).



BPW leaf spring suspensions have in-built self-dampening, and do not require an additional shock absorber.



1 BPW ECO Cargo VB-Suspensions

General, designations

General

Leaf-spring axles from BPW's VB series can be installed as single axles or as multi-axle suspension units. The axles are connected to the vehicle frame by connecting rods, hanger brackets and equalising beams.

Longitudinal forces

Longitudinal forces are transmitted by connecting rods between the axle and hanger bracket. Thanks to their horizontal arrangement, BPW connecting rods guarantee precise axle guidance for minimal tyre wear.

Vertical forces

Vertical forces are transmitted into the vehicle frame by the hanger supports and equalising beams.

Transverse forces

The transverse forces are exclusively transmitted into the vehicle frame via the hanger brackets. They must therefore be braced accordingly with struts, so as not to exceed the permissible torsion loads of the frame's longitudinal beam.

Additional features

Further features and system solutions are contained in the BPW technical documentation.

Your BPW contact partner will be happy to answer any further questions you may have.

Welding:

- ⊙ For all welding activities, the springs, spring clamps and all other sensitive components must be protected against flying sparks and welding spatter.
- ⊙ The earth terminal must under no circumstances be attached to the leaf springs, spring U-bolts or hubs.
- ⊙ No welding at leaf springs!
- ⊙ It is not permitted for the hanger brackets to be heated for straightening work!
- ⊙ Use new bolts and lock nuts when changing the hanger brackets.

Welding methods:

- ⊙ Inert gas welding
Welding wire quality G 4 Si 1 (DIN EN 440)
- ⊙ Manual arc welding
Rod electrodes E 46 2 (DIN EN 499)

Mechanical quality values must be equivalent to basic material S 420 or S 355 J 2

Avoid end cavities and undercutting!

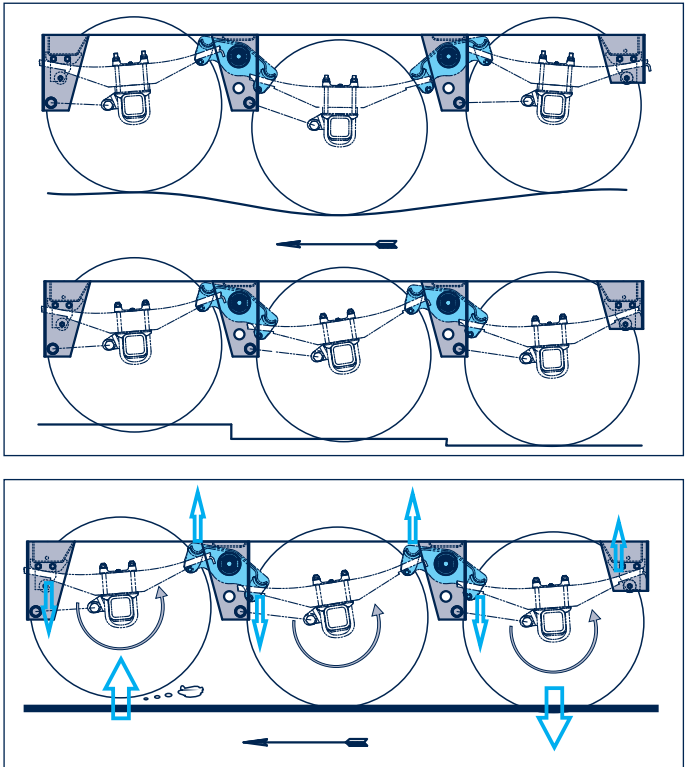
BPW ECO Cargo VB-Suspensions

General, designations, ABS

1

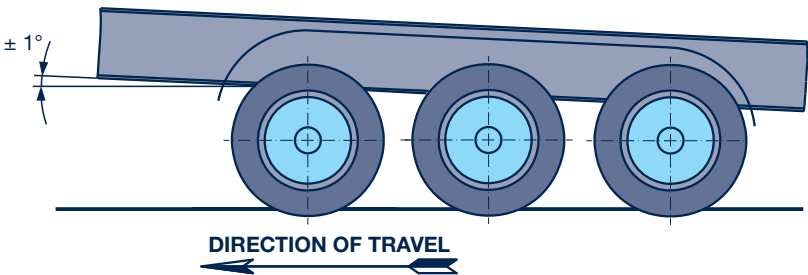
Axle load / brake load equalisation

For multi-axle suspension units, the central brackets feature rotating equalising beams. The spring ends, which slide into the equalising beams, together effect static axle load equalisation (even load distribution when stationary and in drive mode).



Due to the design, dynamic axle load equalisation is not provided (uneven load distribution when braking). The load on the front axle therefore tends to reduce and – if all axles are configured consistently – cause the front axle to overbrake. There is the option to configure the axles differently (brake cylinder dimension and/or lever length). We can produce a brake calculation for your vehicle concept on request. In this case, we recommend the following ABS sensing:

Configuration			
Tandem suspension	recommended	Front and rear axle	4S / 2M or 4S / 3M
	simplified	Front axle	2S / 2M
Tridem suspension (no steering axle)	recommended	Front and rear axle	4S / 2M or 4S / 3M
	simplified	Central axle	2S / 2M



Due to the limited equalisation paths, the maximum body tilt of the semi-trailer may not exceed $\pm 1^\circ$. Otherwise, it should be expected that axle loads will exceed limitations significantly on uneven terrain, which could result in damage to components.

Axle loads:

The axle loads given are maximum values on the ground up to 105 km/h. For vehicles with a lower maximum permitted speed, the following axle load increases are permitted:

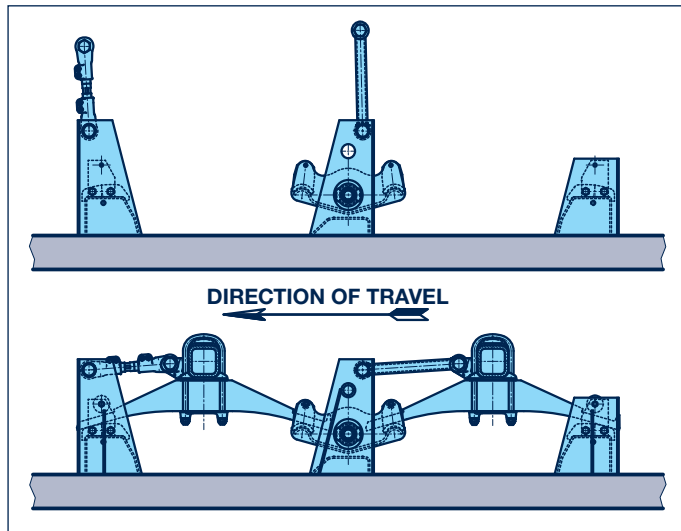
V max. 40 km/h + 10%
V max. 25 km/h + 25%
V max. 10 km/h + 40%

For an axle load increase of over 10%, reinforced multi-leaf springs must be used.

2 Installation guidelines

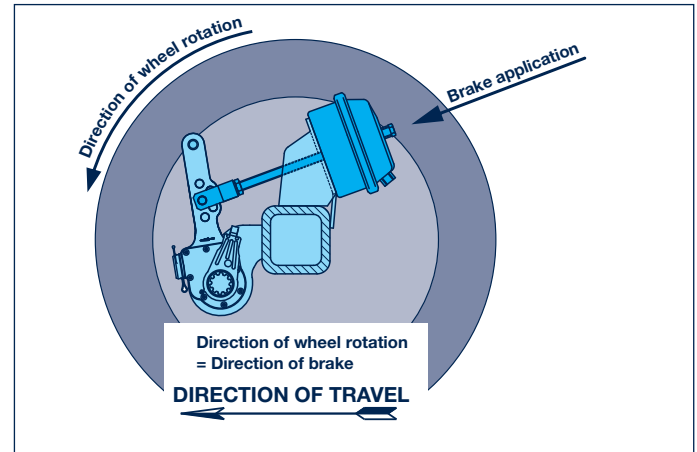
General

BPW VB suspension units are generally supplied unassembled, i.e. axles, hanger brackets and equalising beams are supplied separately on pallets. These suspension units are installed with the vehicle frame on its back.



Axle installation direction:

The brake application direction (rotational direction of the brake camshaft) must correspond to the rotational direction of the wheel when driving forwards.



Assembly

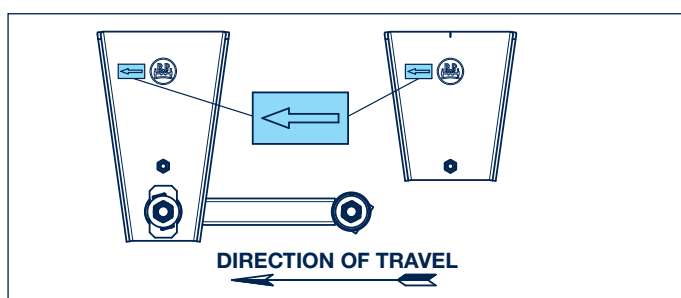
There must be a minimum of 30mm between the chassis and the tyres. Track width, tyre dimensions and longitudinal beam dimensions must be taken into consideration in this regard.

The clearance between brackets in the transverse direction must be within the tolerance range of the spring centre clearance (0, +2) to prevent tensions in the axle unit. After the hanger brackets have been welded on and the axles mounted, an axle alignment check must be conducted and any corrections made as necessary (see Axle tracking, Chap. 6).

Hanger brackets in ECO Cargo VB

The front and rear hanger brackets in the ECO Cargo VB must be welded onto the chassis according to the direction of travel.

A corresponding sticker is present on each hanger bracket.

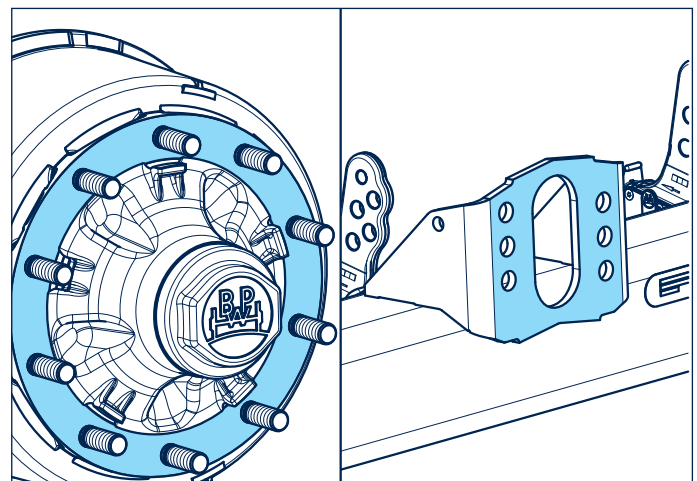


Painting:

The following areas of drum brakes must be covered or masked off prior to any potential painting:

- ⦿ contact surface of the brake cylinder and fixing nuts for non-assembled brake cylinders
- ⦿ wheel contact surfaces

A maximum paint coat thickness of 30 µm must not be exceeded in the area of bolt contact surfaces.



Struts 3

General

We explicitly state that the reinforcement instructions are solely to be understood as examples and component dimensions depend upon the respective vehicle type and its field of application. This data is intended as a guide to be incorporated into the manufacturer's vehicle design.

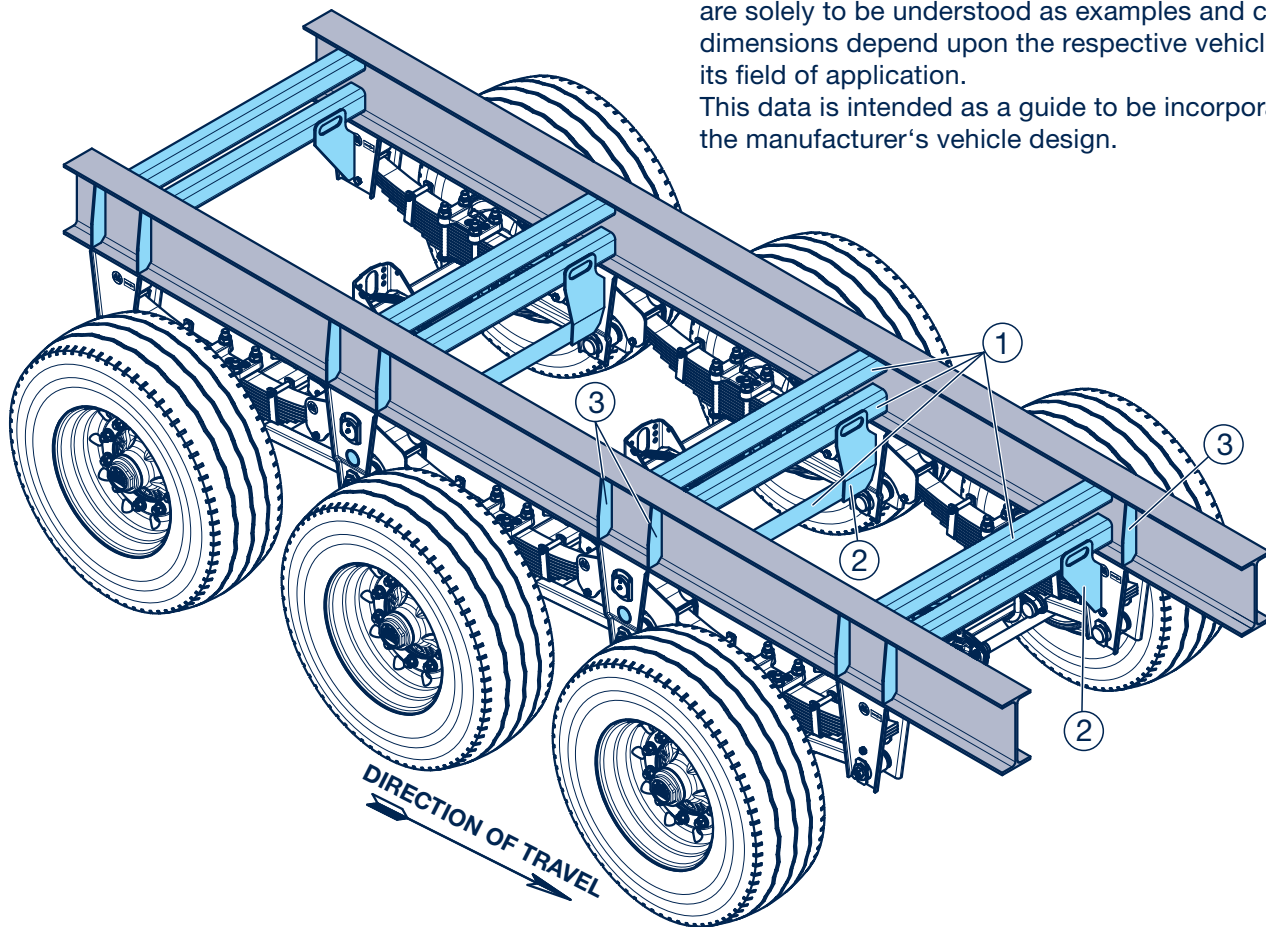


Fig.: ECO Cargo VB Tridem suspension

① Crossmembers

The transverse forces encountered in curve travel are transmitted as bending forces, via the hanger brackets and gusset plates, into the crossmember. The crossmember must be dimensioned accordingly.

For vehicle frames flexible against longitudinal torsion (i.e. for flat-bed, low-loading or some dump trucks), torsion-flexible crossmembers (with open profiles) must be used (except for connecting rod of central hanger bracket). The crossmembers should be connected to the longitudinal beams via the web plates and not via the flanges.

For vehicles with longitudinally torsion-resistant frames (tankers, box trucks), torsion-resistant crossmembers may also be used.

② Gusset plates

The gusset plates serve to connect the hanger brackets to the transverse beams in order to spread the transverse forces. Suitable designs are described in the following.

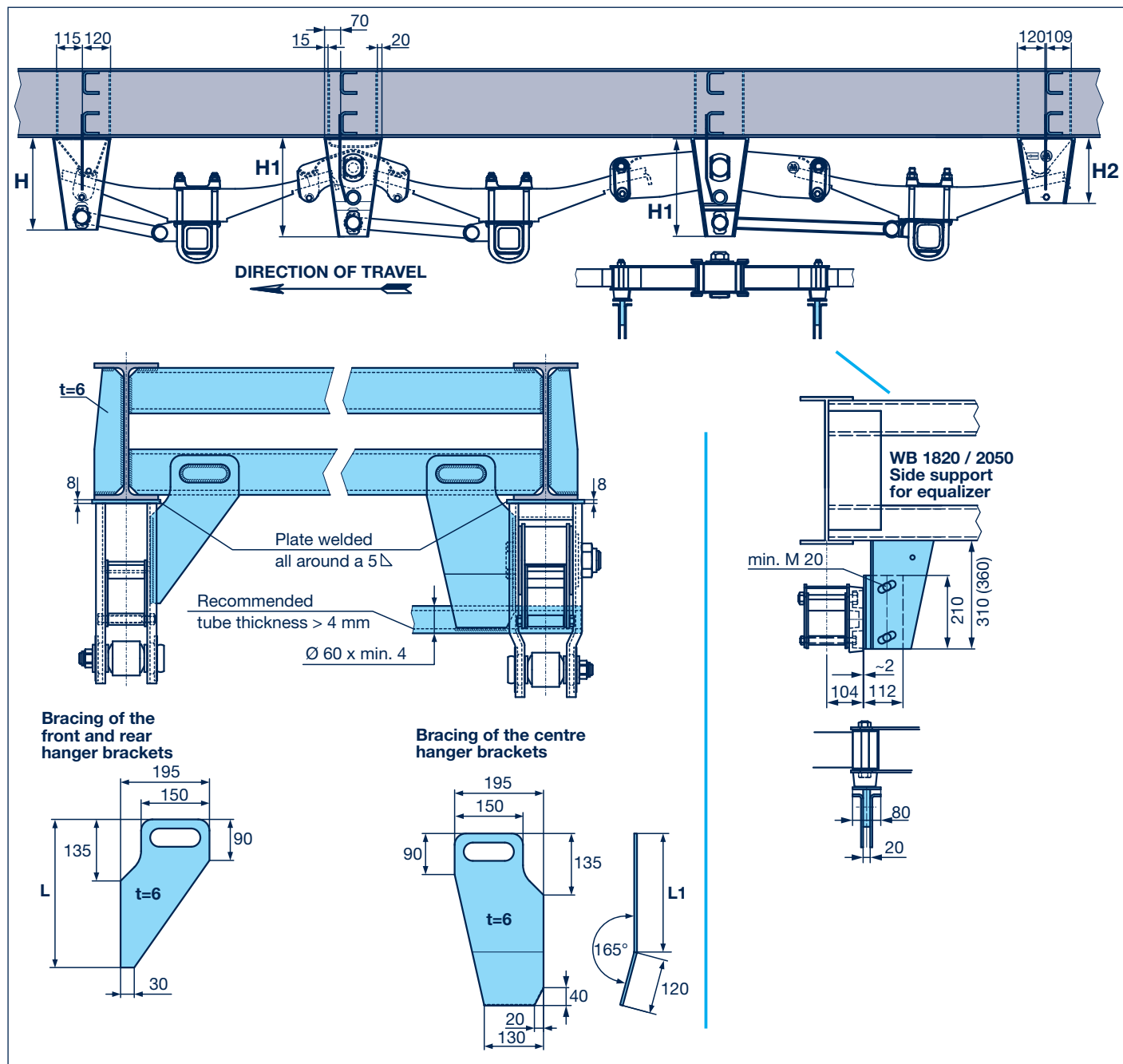
③ Vertical profiles

Vertical profiles, such as ribs, provide local reinforcement to the longitudinal beam and are recommended in the hanger bracket area.

3 Reinforcement instructions for VB suspensions

(is not supplied by BPW)

Example: Reinforcement instructions ECO Cargo VB Tridem suspension



Bracing of the hanger brackets

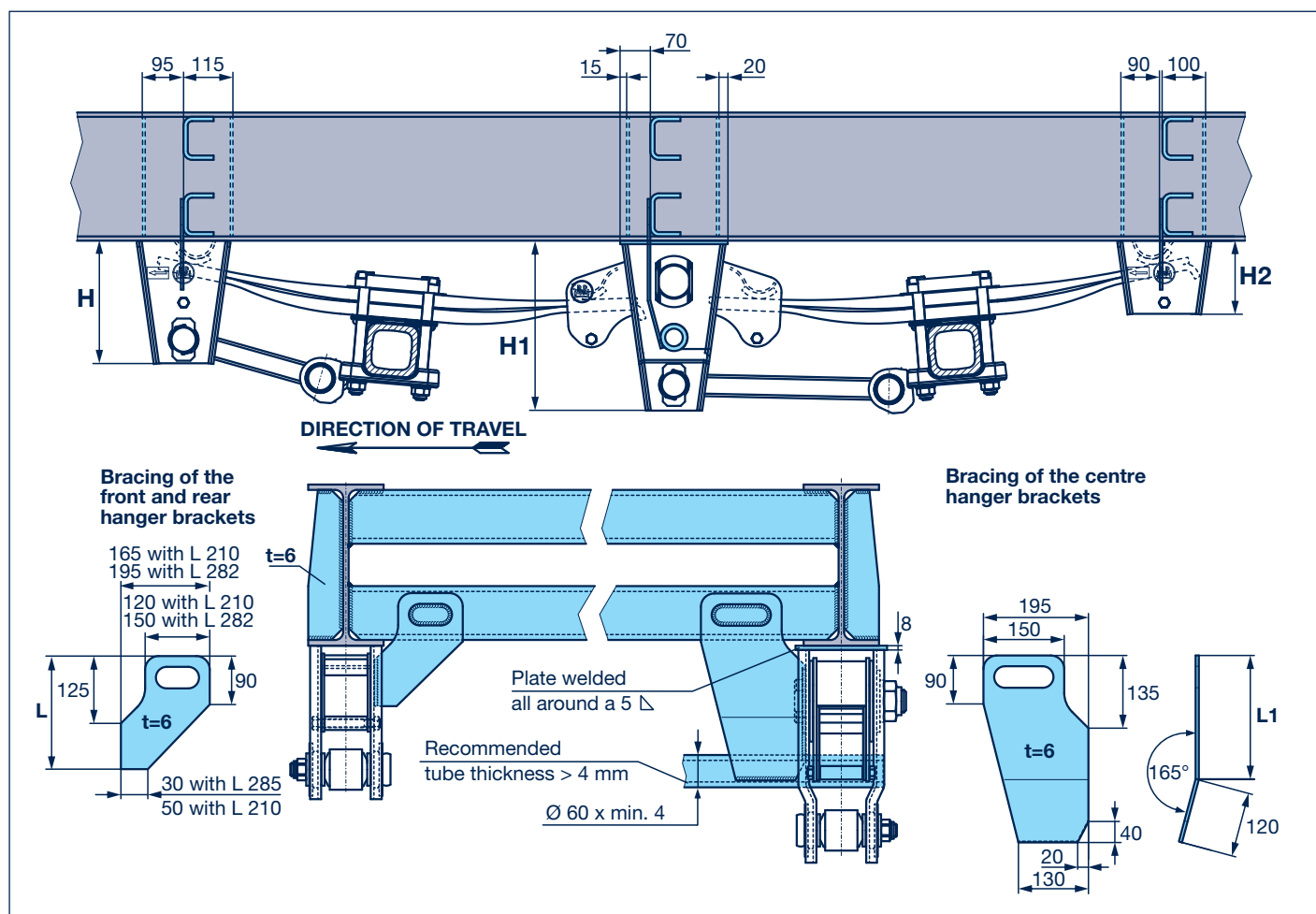
Hanger bracket height	L	L1
H	395	325
H1	425	260
H2	280	230

Reinforcement instructions for VB suspensions

3

(is not supplied by BPW)

Example: Reinforcement instructions tandem suspension with parabolic springs

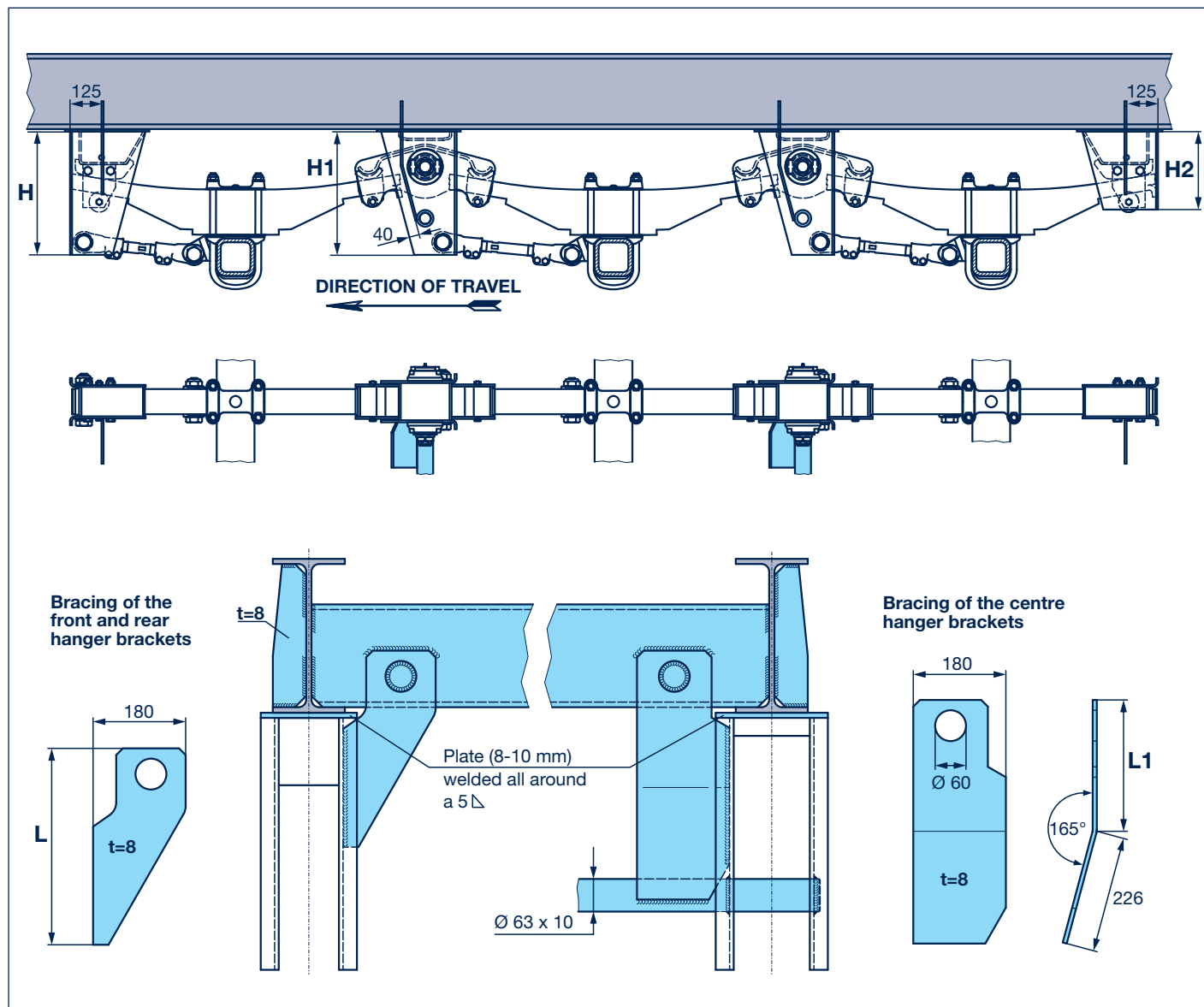


Bracing of the hanger brackets			
Hanger bracket height		L	L1
H	285	210	
H	357	282	
H1	395		230
H2	170	210	
H2	242	282	

3 Reinforcement instructions for VB suspensions

(is not supplied by BPW)

Example: Reinforcement instructions ECO Cargo VB HD

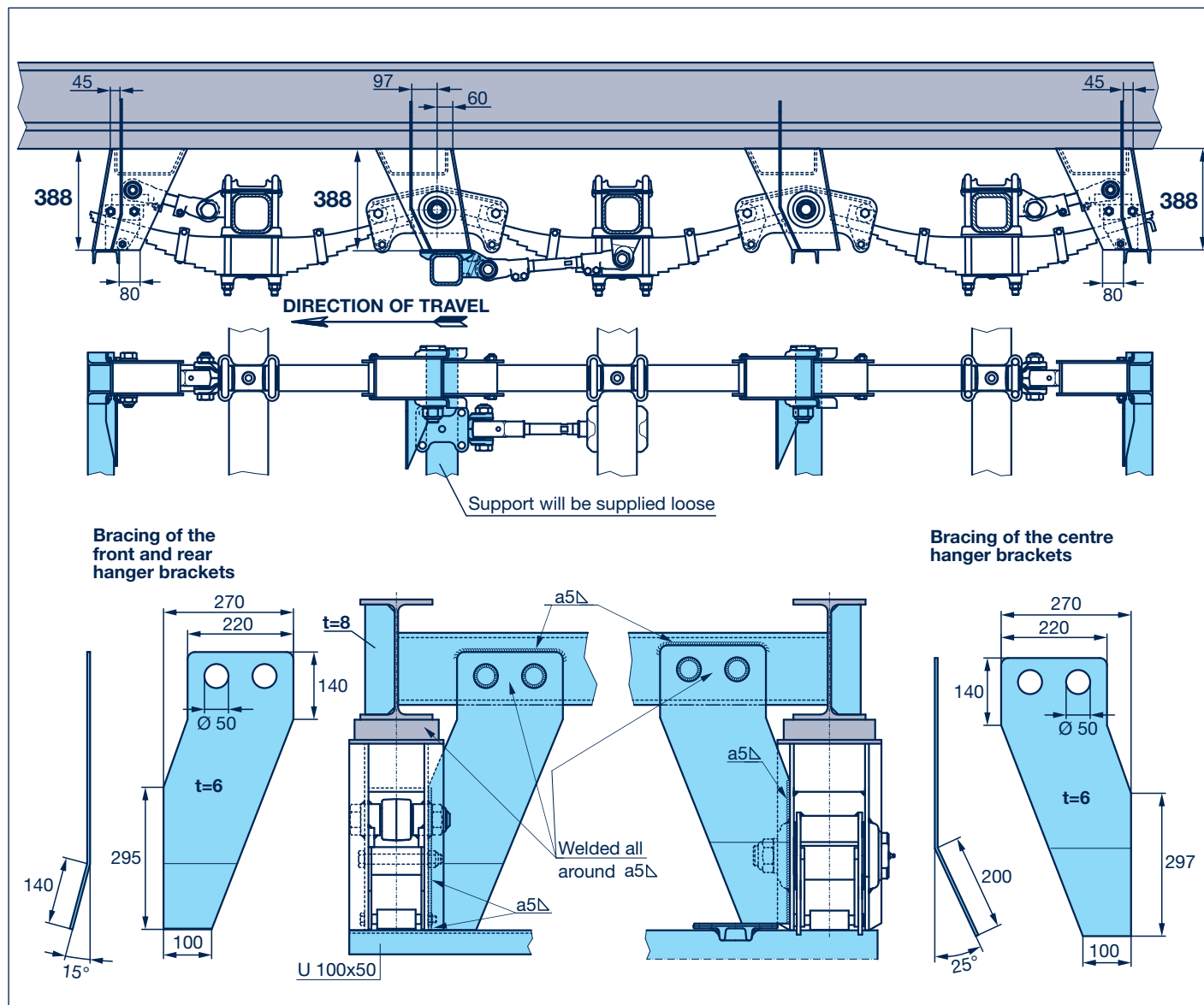


Bracing of the hanger brackets			
Hanger bracket height		L	L1
H	490	382	
H1	490		255
H2	310	382	

Reinforcement instructions for VB suspensions 3

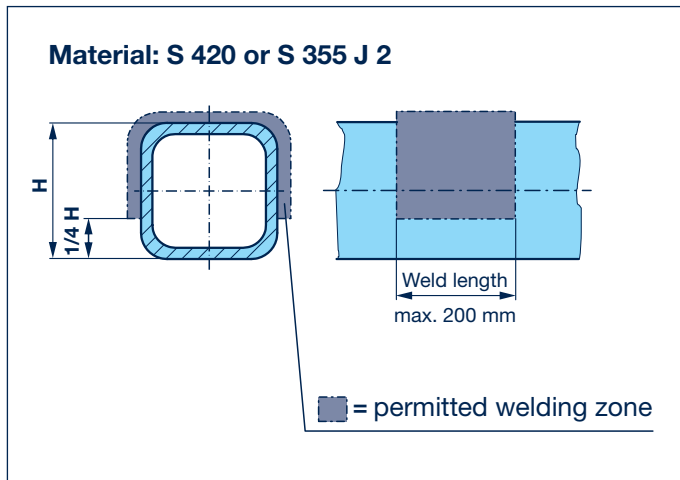
(is not supplied by BPW)

Example: Reinforcement instructions ECO Cargo VBT Tridem suspension



4 Axle beams

Welding guidelines for axle beams



General

When installing trailer axles, it may be necessary to subsequently weld components onto the axle beam. BPW axles are therefore made of weldable material. The axle beams do not need to be heated prior to welding.

The load-bearing strength and perfect functioning of the BPW axles are not reduced by welding work if the following points are observed.

Welding methods:

- ⊙ Inert gas welding
Welding wire quality G 4 Si 1 (DIN EN 440)
- ⊙ Manual arc welding
Rod electrodes E 46 2 (DIN EN 499)

Mechanical quality values must be equivalent to basic material S 420 or S 355 J 2

Avoid end cavities and undercutting!

IMPORTANT:

Do not alter the camber or tracking of the axles except within BPW tolerances.

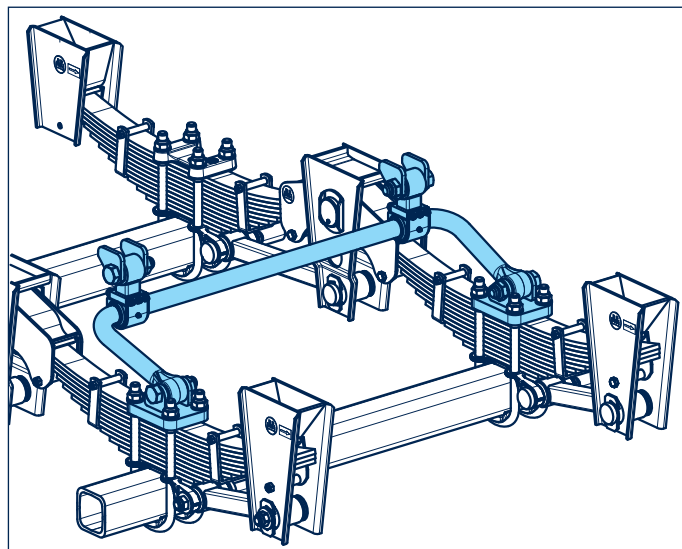
Observe the welding zones and weld lengths shown in the adjacent diagram.

No welding must be undertaken in the lower tensile area of the axle beam!

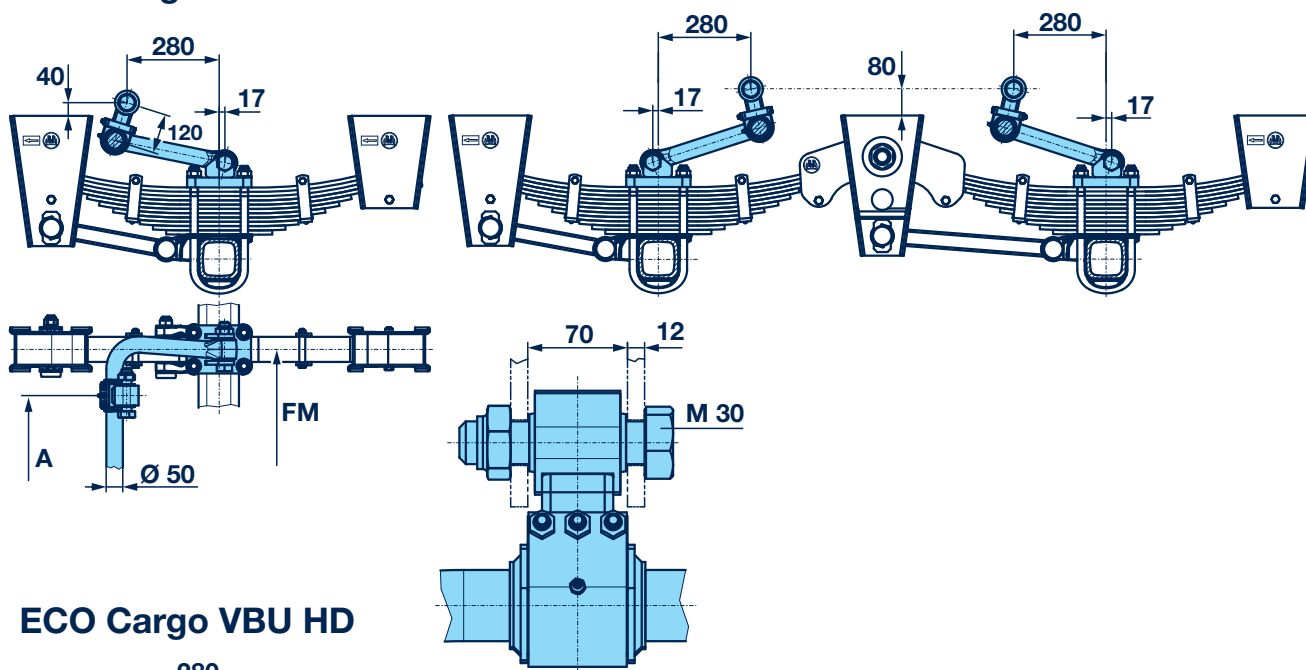
U-Stabilisers 5

BPW VB suspension with U-stabiliser (VBU)

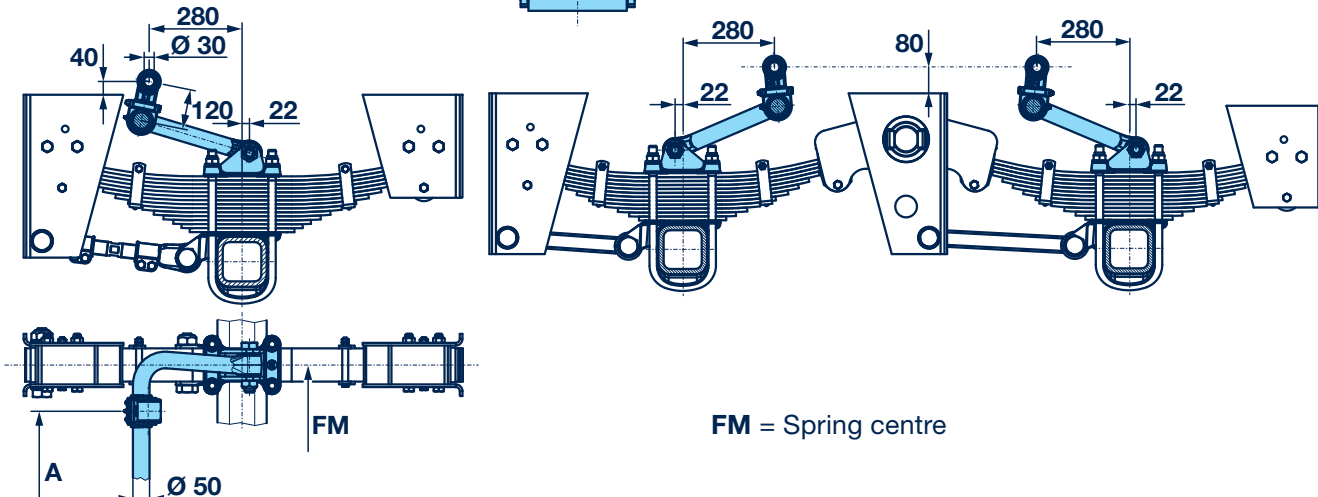
In the case of special roll stability requirements, e.g. for vehicles with a high centre of gravity, BPW VB suspensions can additionally be equipped with one or more stabilisers.



ECO Cargo VBU

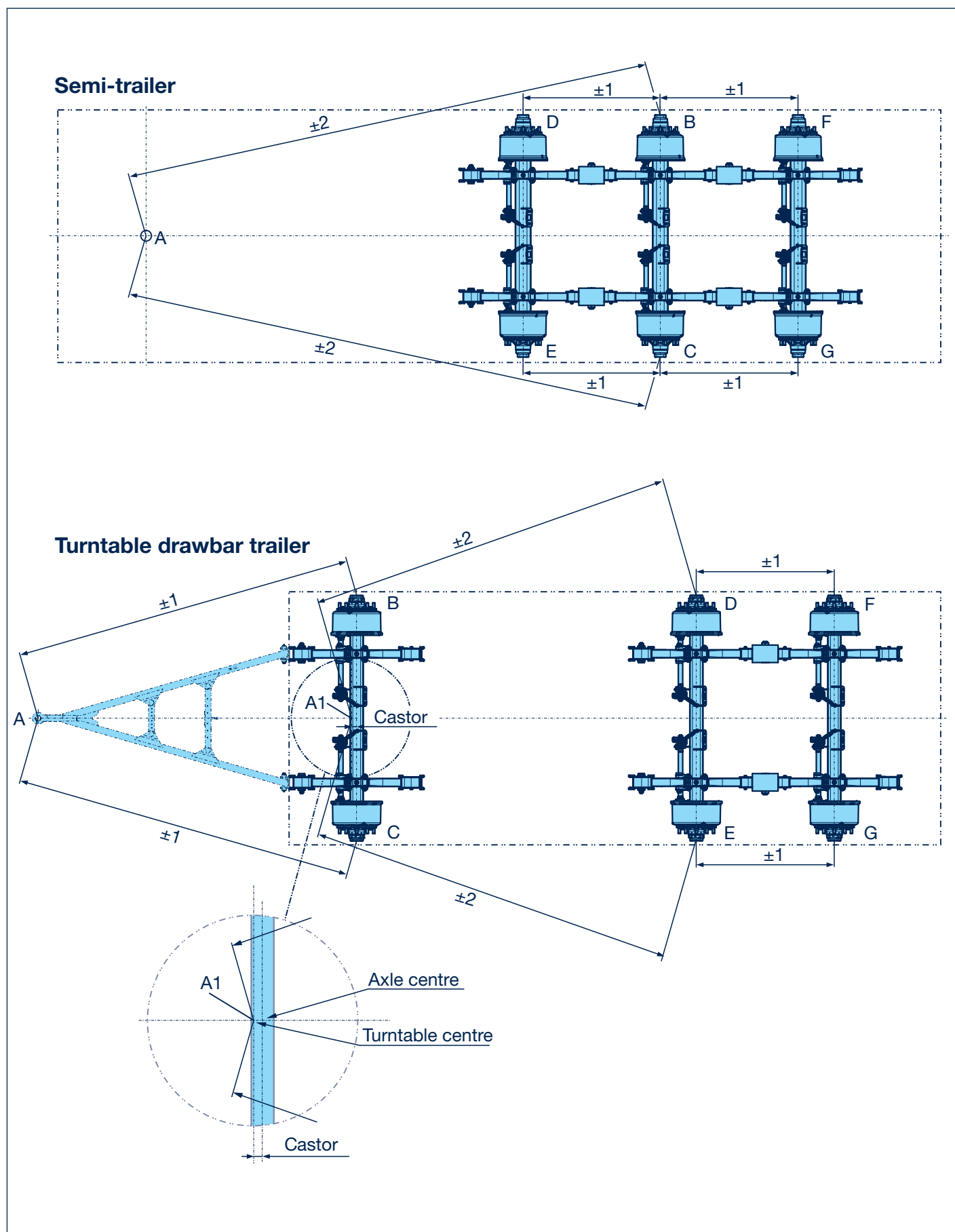


ECO Cargo VBU HD



6 Axle alignment

6.1 Axle alignment conventionel



Axle alignment 6

Axle alignment conventional 6.1

To compensate for manufacturing tolerances, an axle alignment check must be conducted and any corrections made as necessary.

Semi-trailers:

Determine diagonal dimensions **A - B** and **A - C** for the centre axle (reference axle) using comparative measurements and correct if necessary.

Check wheel base measurements **B - D** and **C - E** for the front axle and **B - F** and **C - G** for the rear axle and correct if necessary.

Turntable drawbar trailers:

Determine diagonal dimensions **A - B** and **A - C** for the front axle (reference axle) using comparative measurements and correct if necessary.

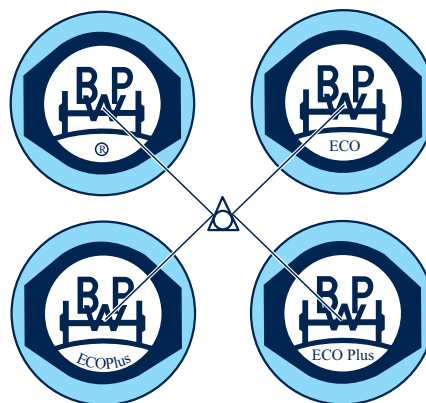
Determine diagonal dimensions **A1 - D** and **A1 - E** for the centre axle using comparative measurements and correct if necessary.

Check wheel base measurements **D - F** and **E - G** for the rear axle and correct if necessary.

Measurements are generally taken from the centre of the hub cap (Fig.).

Screwed-in measuring tubes may also be used.

The triangle in the BPW logo is in the centre.

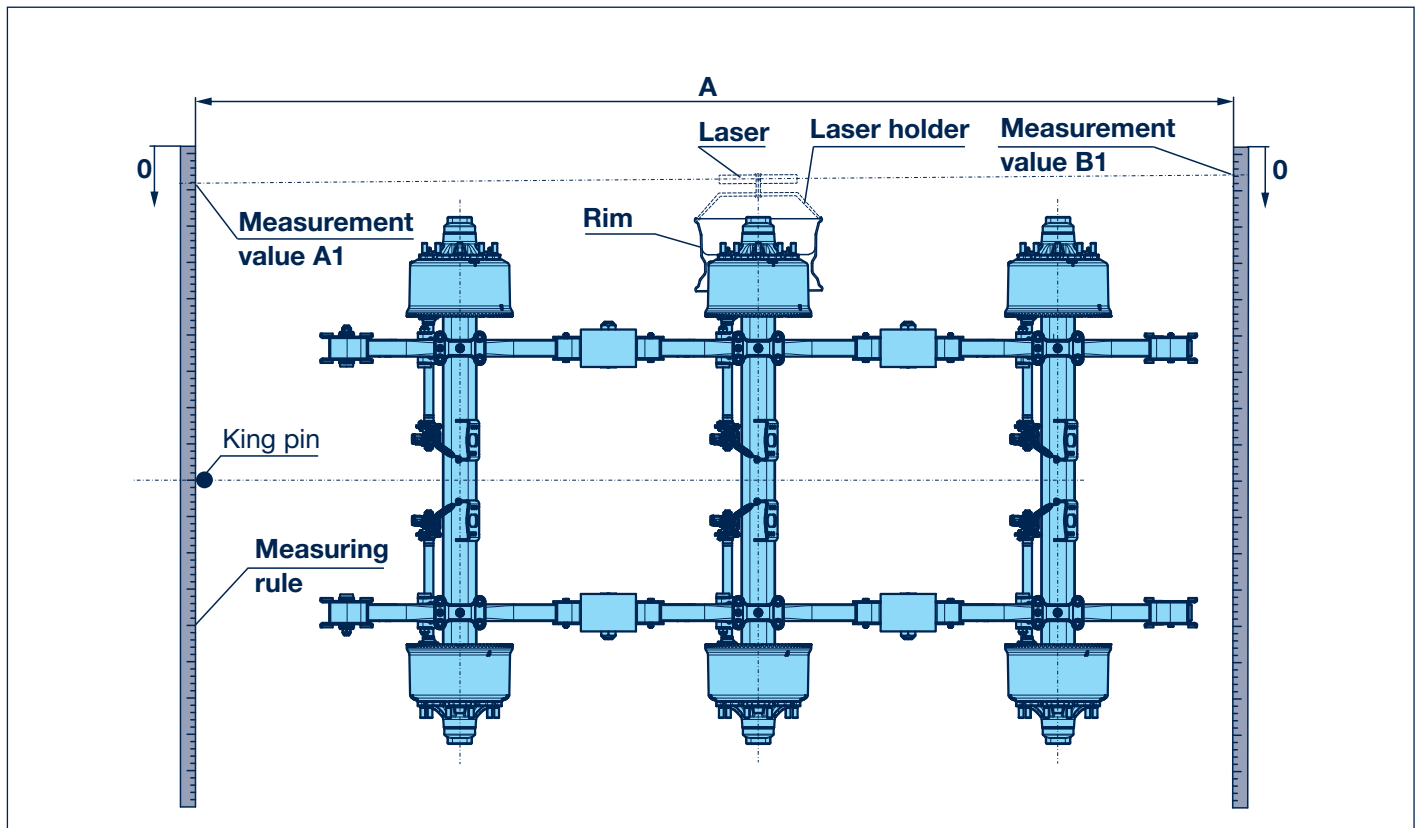


IMPORTANT:

The tracking tolerances defined by BPW must be maintained. Only by maintaining these tolerances can low-wear operation of the vehicle be assured. The tracking values are set for steered axles at the factory and the steering rod must not be adjusted.

6 Axle alignment

6.2 Axle alignment with laser measuring system



If laser measuring systems are used, care must be taken to ensure that the axle is aligned **horizontally** with the base in order to obtain a correct measurement as otherwise the camber values will affect the result.

The operating and setting instructions of the system manufacturer must be adhered to!

The maximum possible wheelbase correction per axle is ± 5 mm for adjustable hanger brackets (see track settings with adjustable hanger brackets).

Calculation of the toe-in and toe-out settings:

$$\frac{A1 - B1 \text{ (mm)}}{A \text{ (m)}} = \text{track width}$$

Positive value = toe-in

Negative value = toe-out

The measurement must be performed on both sides of the axle. The measurement values are then added together.

The total of the values is the toe-in/toe-out value of the axle and must be within the permitted tolerance range (-1 to +5 mm/m).

IMPORTANT:

The tracking tolerances defined by BPW must be maintained. Only by maintaining these tolerances can low-wear operation of the vehicle be assured.

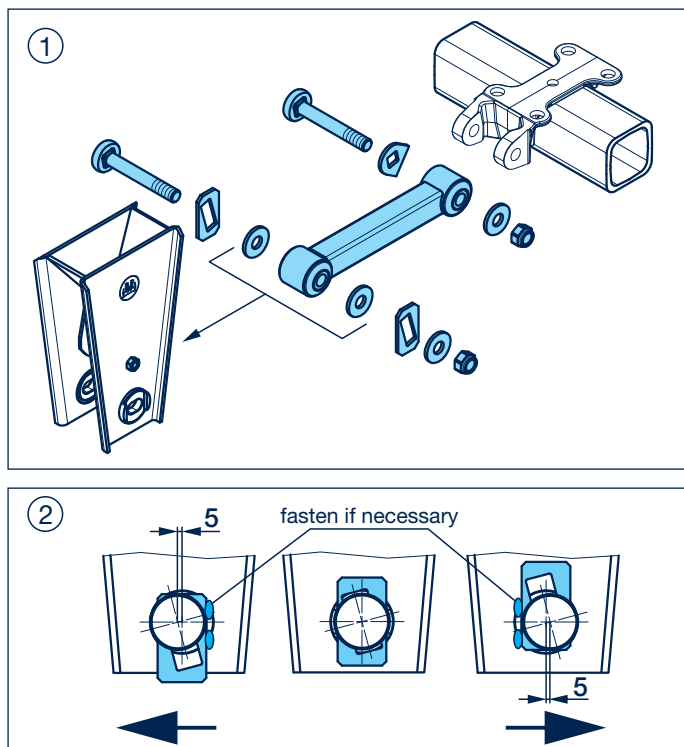
The tracking values are set for steered axles at the factory and the steering rod must not be adjusted.

Axle alignment 6

Axle alignment correction 6.3

ECO Cargo VB

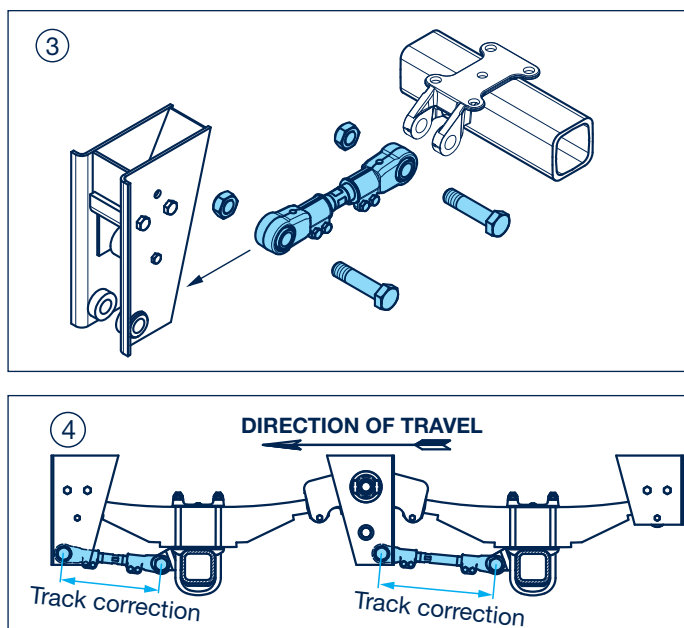
The maximum possible wheel base correction per axle for adjustable hanger brackets (ECO Cargo VB) is ± 5 mm.



ECO Cargo VB HD / VBT

Each rigid and adjustable connecting rod enables easy tracking of the suspension axles.

For some suspension unit versions, two adjustable connecting rods are also fitted for each axle.



Axle alignment correction

1. Raise and support the vehicle frame.
2. Loosen locking nut M 24 (SW 36) on the connecting rod mounting (Fig. ①).
3. For Tandem: firstly align the rear axle, then the other axle.
For Tridem: firstly align the centre axle, then the other axles.
4. Slide the connecting linkage on both sides, as required, upwards or downwards with light hammer blows (Fig. ②).
5. **Make sure the inner and outer connecting linkages on each hanger bracket are adjusted symmetrically!**
6. Tighten locking nut M 24 (SW 36) with the prescribed tightening torque.
M = 650 Nm (605 - 715 Nm)
7. For difficult road conditions, the connecting linkages can be affixed following alignment (Fig. ②).
8. Remove supports under the vehicle frame.

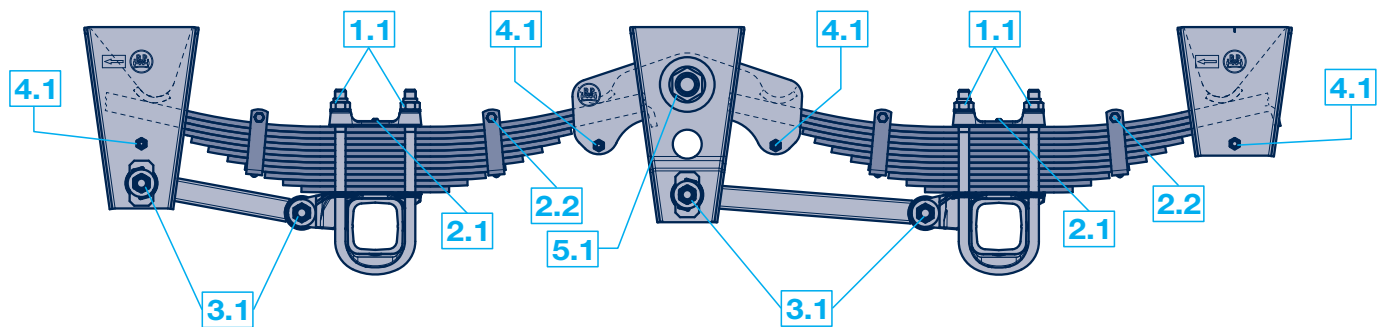
Axle alignment correction

1. Raise and support the vehicle frame.
2. Loosen locking nuts M 12 / M 14 from the connecting rod clamp connections (Fig. ③).
3. For Tandem: firstly align the rear axle, then the other axle.
For Tridem: firstly align the centre axle, then the other axles.
4. Align the axle by turning the adjusting spindle (left-right thread) (Fig. ④).
5. Tighten locking nuts M 12 / M 14 with the prescribed tightening torque.
M 12 M = 66 Nm
M 14 M = 140 Nm
6. Remove supports under the vehicle frame.

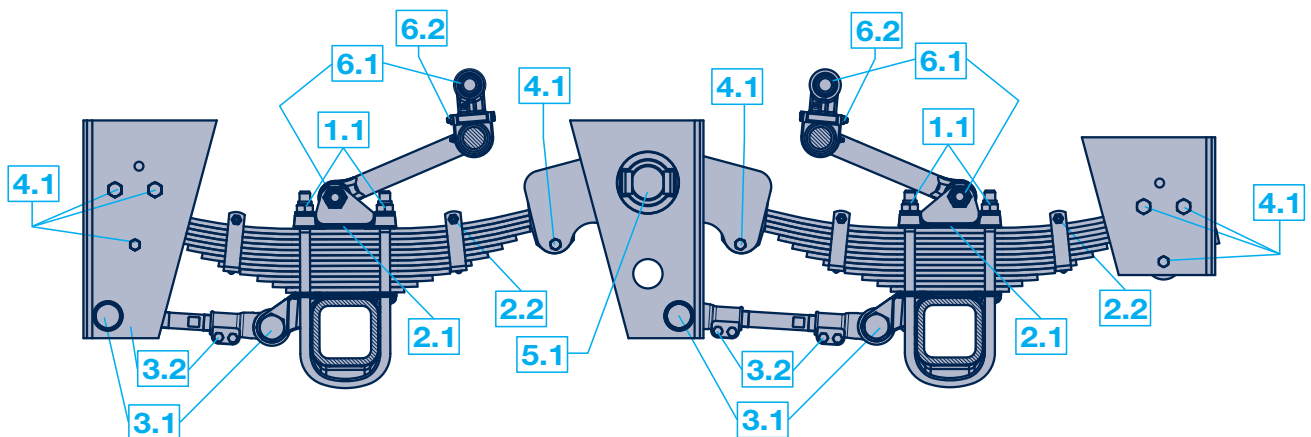
7 Tightening torques

Fig. examples

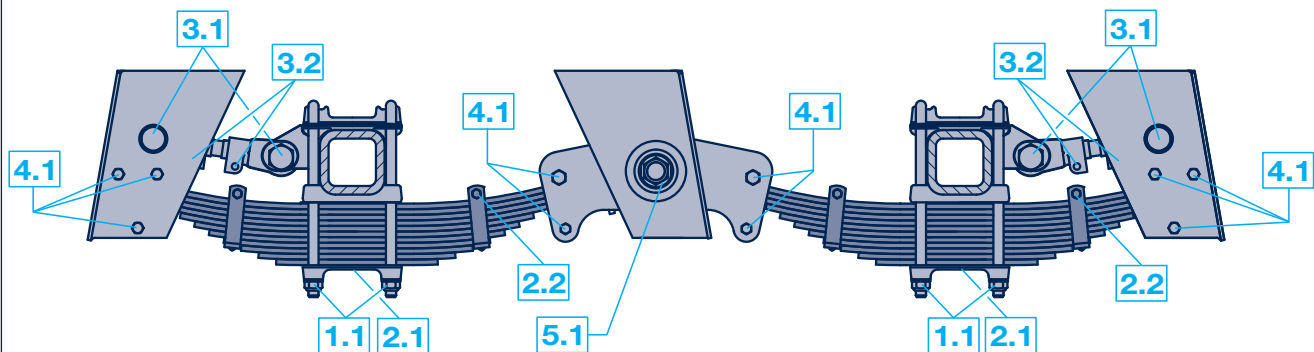
ECO Cargo VB



ECO Cargo VB HD / VBU HD



ECO Cargo VBT HD



Tightening torques 7

Area	Item	Attachment	Remark	Thread	SW	Tightening torque (thread lightly greased)
						Suspension series VB / VBT
1 Spring U-bolts						
	1.1	Spring U-bolts ¹⁾		M 24-8.8	36	(600 - 650 Nm)
2 Leaf springs						
	2.1	Centre bolt of leaf spring		M 16	24	163 Nm
	2.2	Nuts of the leaf spring clamps		M 12	19	66 Nm
3 Connecting rods						
	3.1	Lock nuts of the axle / connecting rods		M 24 x 2	36	650 Nm
				M 30	46	725 Nm
				M 36	55	1425 Nm
	3.2	Connecting rod clamping bolts		M 12-8.8	19	66 Nm
				M 14-8.8	22	140 Nm
4 Sliders / Supports						
	4.1	Attachment sliders / supports	ECO Cargo VB	M 14	22	140 Nm
			ECO Cargo VB HD, VBT	M 20	30	320 Nm
5 Equalizing arm bearing						
	5.1	Lock nuts on the equalizer arm bearing	ECO Cargo VB 9 - 12 t	M 42 x 3	65	1300 Nm
			ECO Cargo VB HD, VBT	M 48 x 3	65	1250 Nm
6 U-stabilizer						
	6.1	Lock nuts of securing bolt for U-stabilizer		M 30	46	700 - 750 Nm
	6.2	Lock nuts of securing bolts for shaped plate		M 10-10.9	17	53 Nm

¹⁾ Apply grease to the threads of the spring U-bolts and nut contact surfaces.

Attention: Suspension units with bronze bearings on the equalising beams (**ME** and **HDE** models) must be lubricated with BPW ECO^UPlus grease before commissioning.

Notes

Notes